Gas Stream Dynamics in Algol-Type Interacting Binary Systems

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The K2 mission and the modeling capabilities of the Wilson-Devinney (WD) binary system analysis program present a unique opportunity to probe gas stream dynamics and/or magnetic activity via recently discovered brightness changes in unusual binaries that we call L/T (Leading/Trailing hemisphere) variables. The L/T phenomenon was discovered in Kepler data and has never been reported in ground-based photometry. L/T behavior is likely due to changes in either hot accretion or cool magnetic spots. In the hot spot interpretation the impact site's location and movement can be diagnostic of stream dynamics that may be modulated by magnetic fields. In the cool spot scenario the variability is a consequence of magnetic activity on the mass loser. We propose K2 observations of 22 Algol systems in K2 Fields 6 and 7 to study mass transfer dynamics and the importance of magnetic fields. Most systems are to be observed in LC mode, while SC observations are proposed for two systems that have total eclipses. Kepler SC photometry is especially useful for modeling magnetic spot activity on the secondary (revealed during the total eclipse and transit of the secondary) and confirmation of a gas stream (seen as added extinction just before the ingress phase of the primary eclipse). The K2 Fields contain system types that have not been found in the Kepler Field, including more massive (B-type) Algols, Algols in which the stream impacts the star at a shallow angle or misses it to feed an accretion disk, and systems with total eclipses. The K2 light curves will be modeled with the WD program. Stellar and spot parameters, including spot motions, will be determined so as to generate a virtual image of the binary versus time. This project will yield information on the detailed physics of mass transfer, especially the roles of accretion hot spots and magnetic fields. The revised WD program will be made available for future applications by others working with the Kepler database.